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Background

- There exists a need to understand factors that support attention in naturalistic settings, like classrooms, especially for children with ADHD.
- The alpha-band oscillations show large group effects related to working memory-deficit ADHD.
- But correlations between alpha and academic performance are low (Lenartowicz et al., 2014; Lenartowicz et al., 2019).
- Why?* We need to study attention deficit in natural environment.

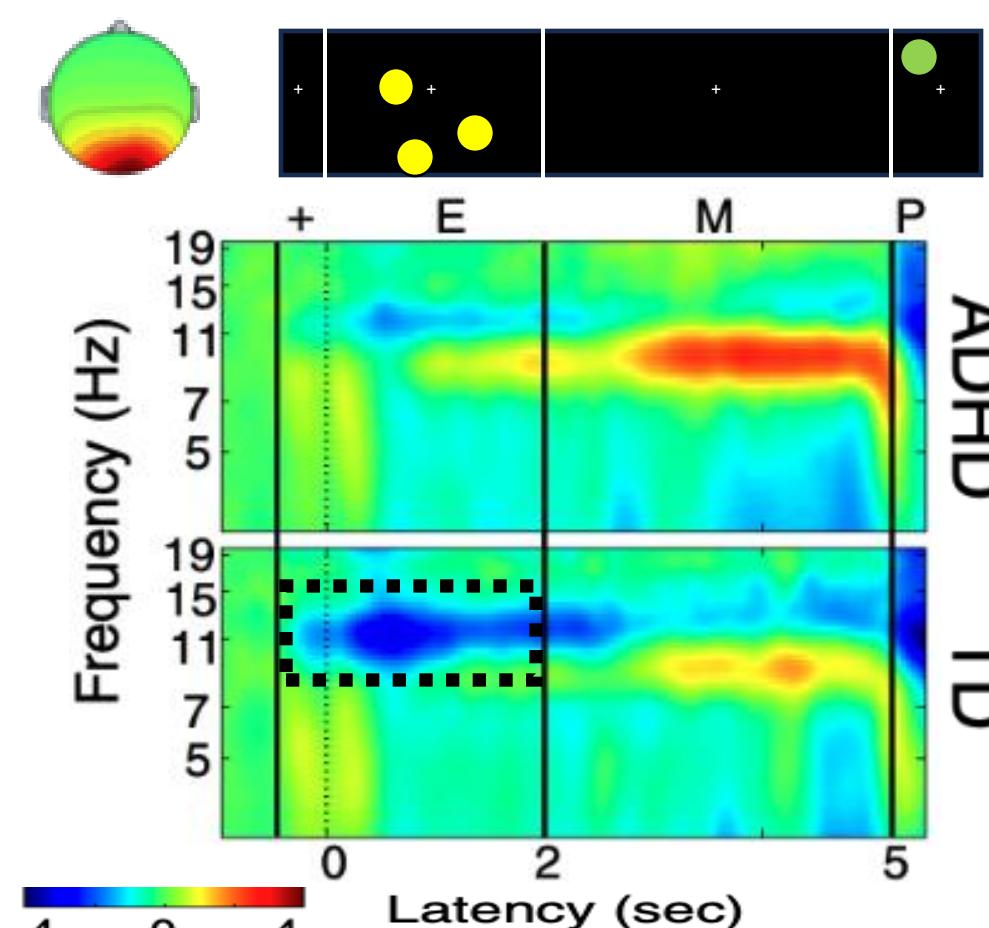


Fig.1 (left)
Alpha ERD decreased during the encoding in both TD and ADHD (Lenartowicz et al., 2014).

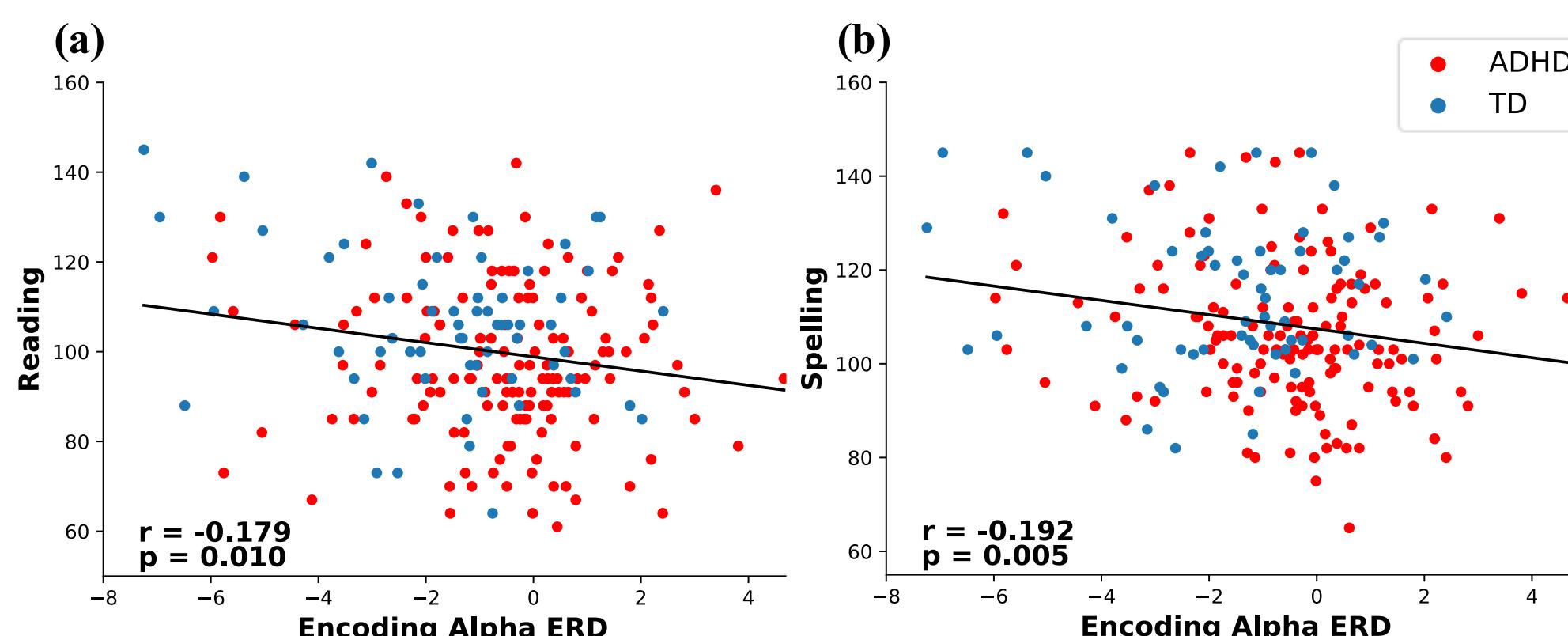


Fig.2 Correlations between (a) reading and (b) spelling with encoding alpha ERD.

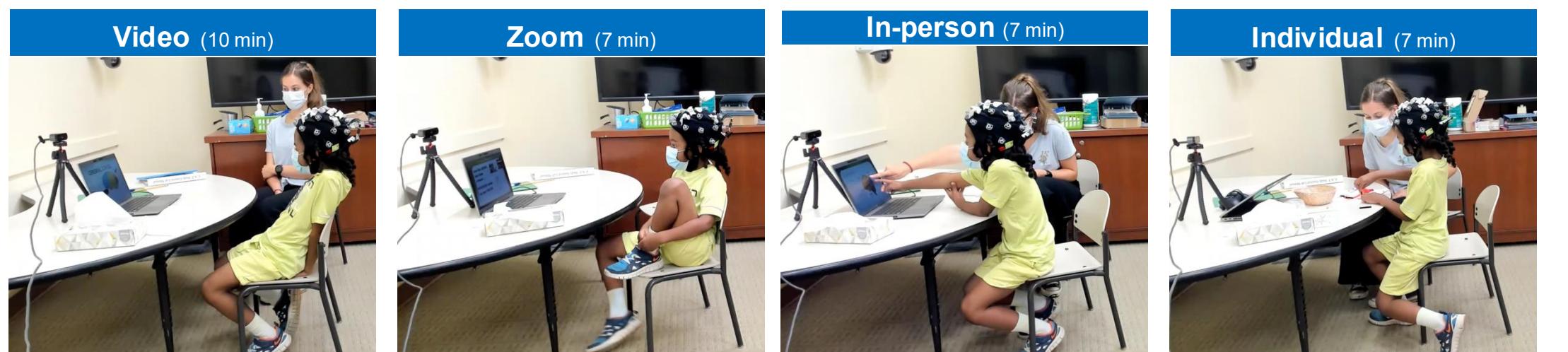
Research Questions

- Does instructional context affect attention?
- Does this differ for children with ADHD?
- How does lab task performance correlate with attention measured during learning activities?

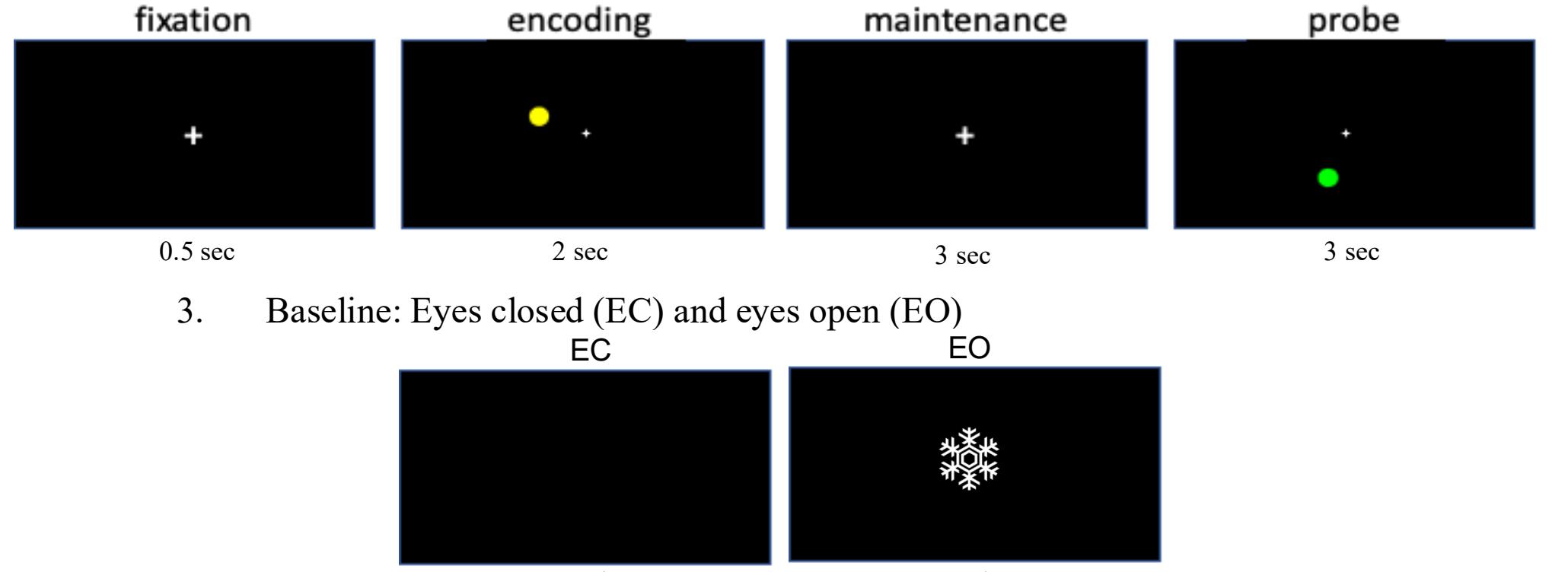
Methods

- Participants:** 55 children (age: 8.5 yr; M:F = 30:25; ADHD = 13)
- EEG data:** digitized at 250 Hz using Smarting MOBI with a 24-channel saline cap
- EEG recording:**

- Naturalistic:** four learning activities with different learning modalities with an instructor



2. **Lab:** spatial working memory (SWM) task – load 1 & load 3



- EEG analysis:** FOOOF Python was used to extract alpha power (9-10 Hz) in the posterior (O1, Poz, O2) cluster for naturalistic, lab, and baseline EEG data.

Results

1.1 Naturalistic: Learning Activities

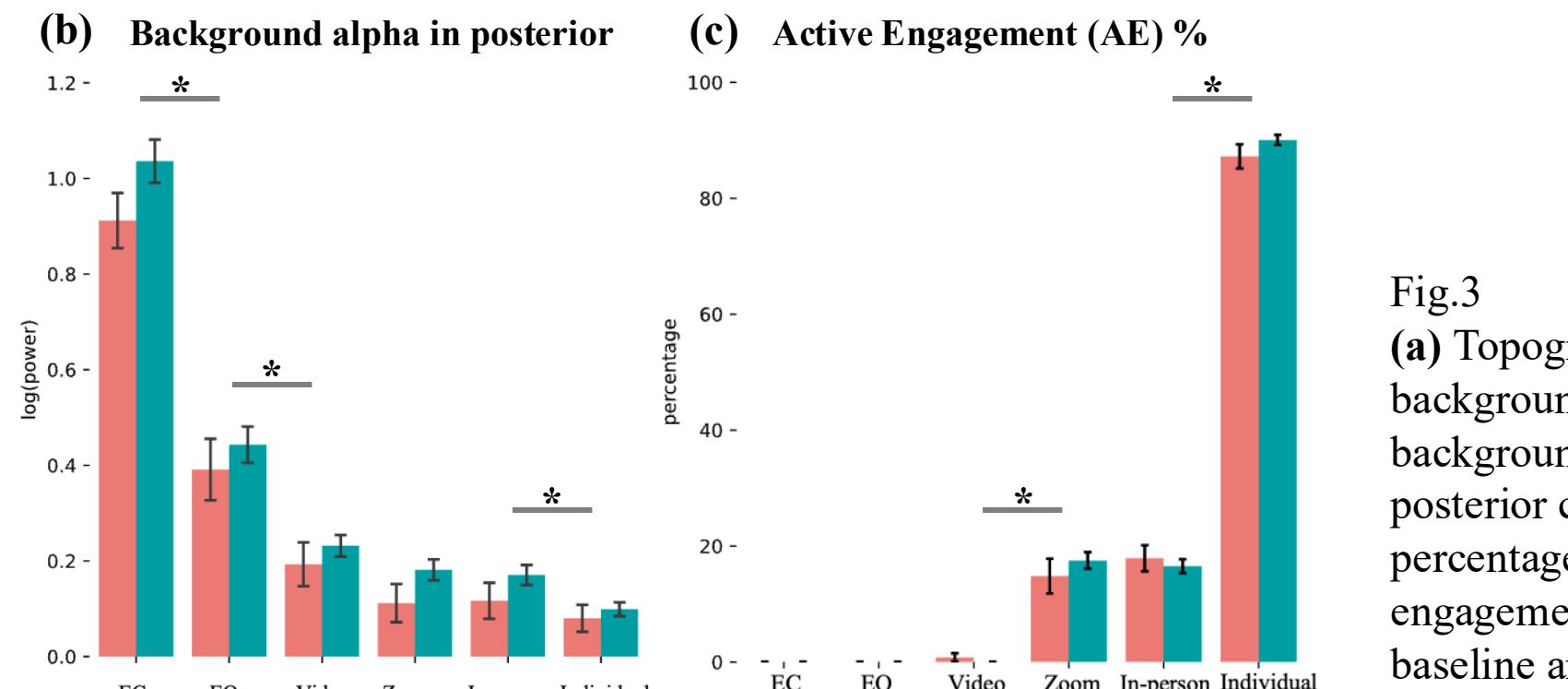
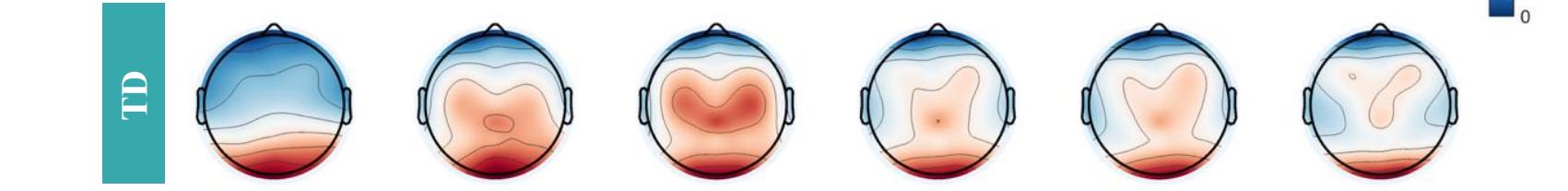
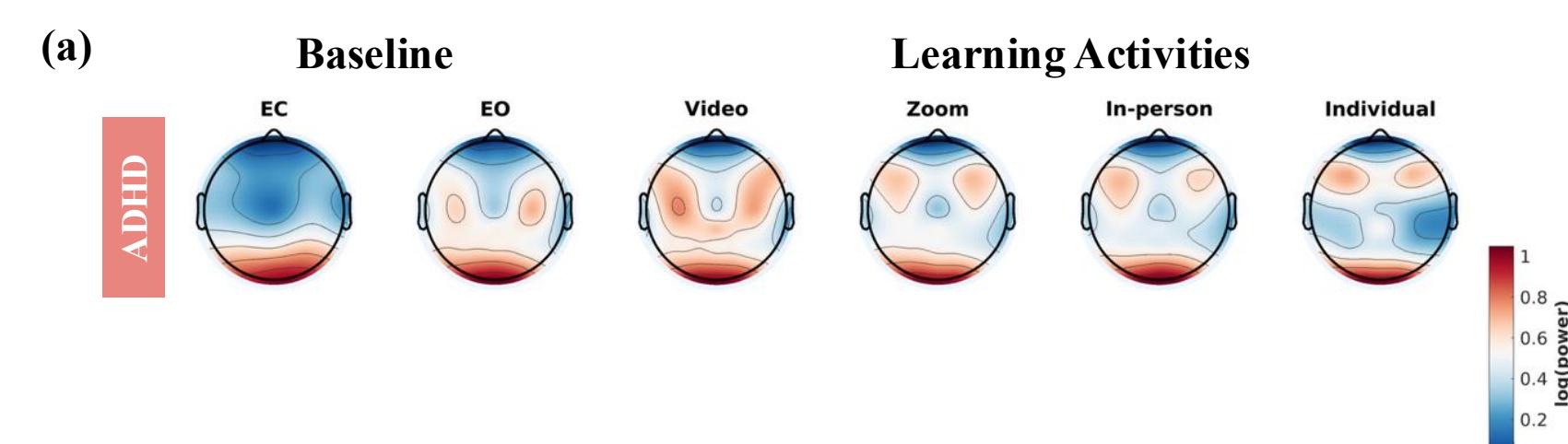
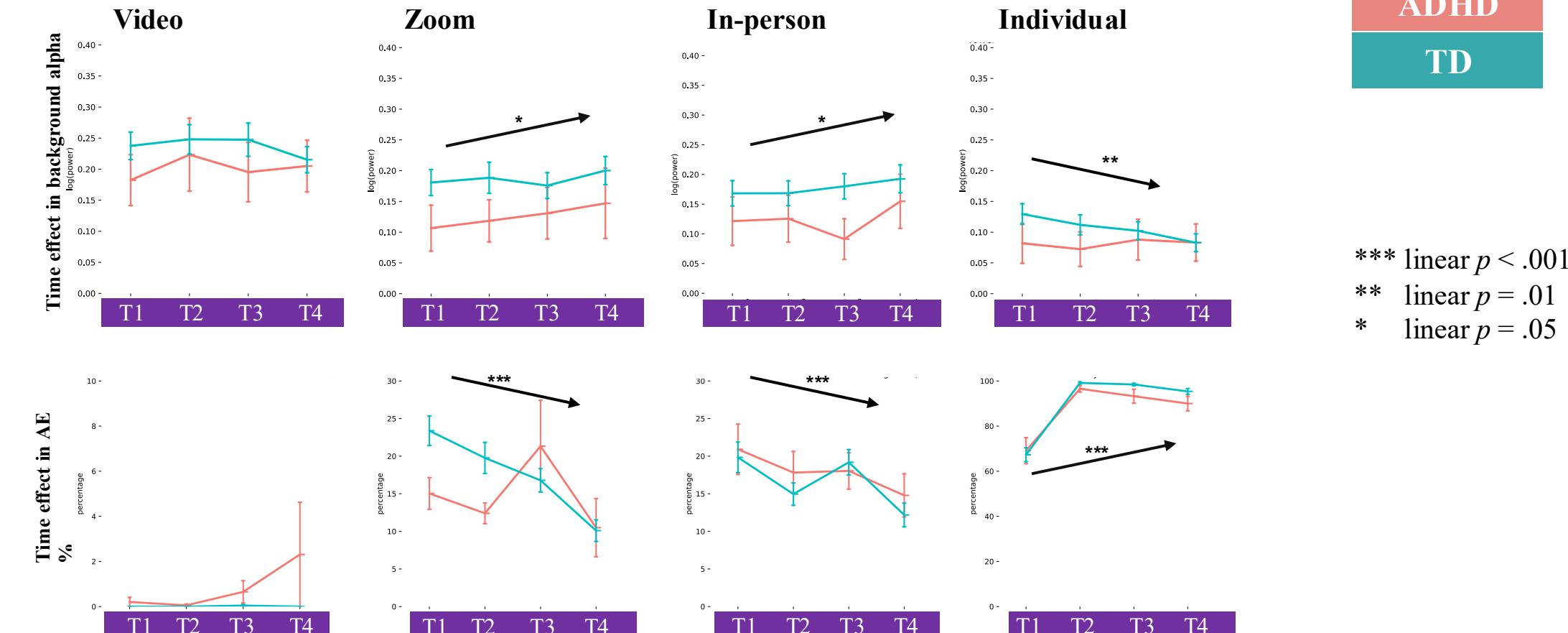


Fig.3
(a) Topography of the background alpha; (b) the background alpha of the posterior cluster; (c) the percentage of active engagement (AE%) during baseline and activities.

Results (cont.)

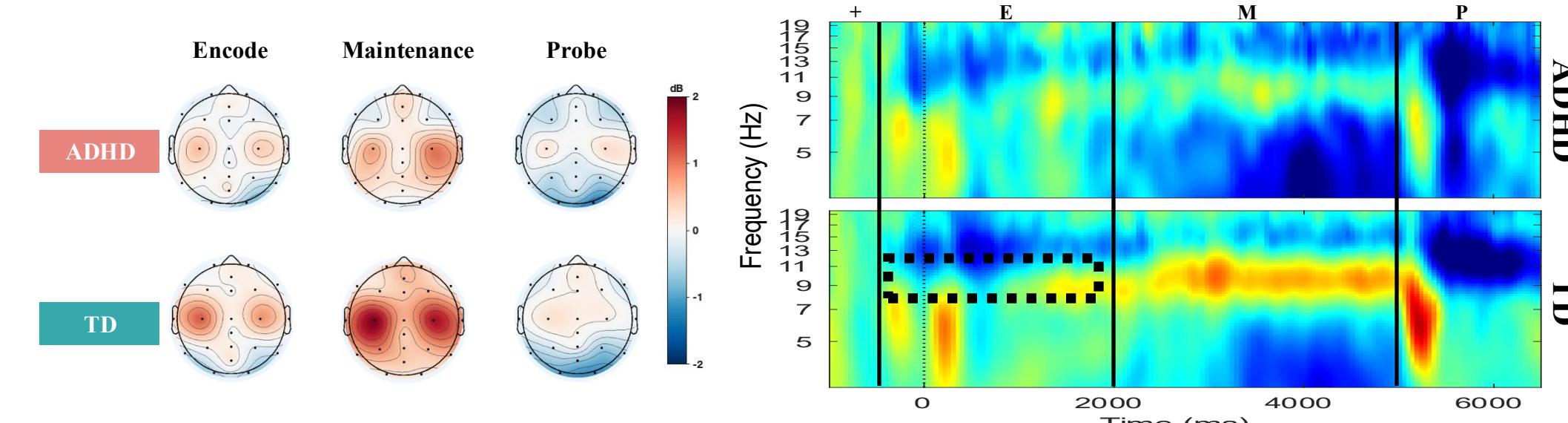
1.2 Naturalistic: Learning Activities – Time Effect



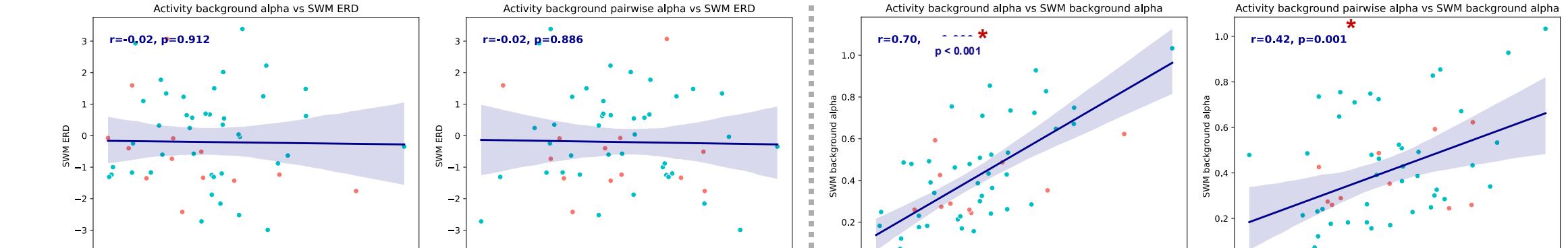
ADHD
TD

*** linear $p < .001$
** linear $p = .01$
* linear $p = .05$

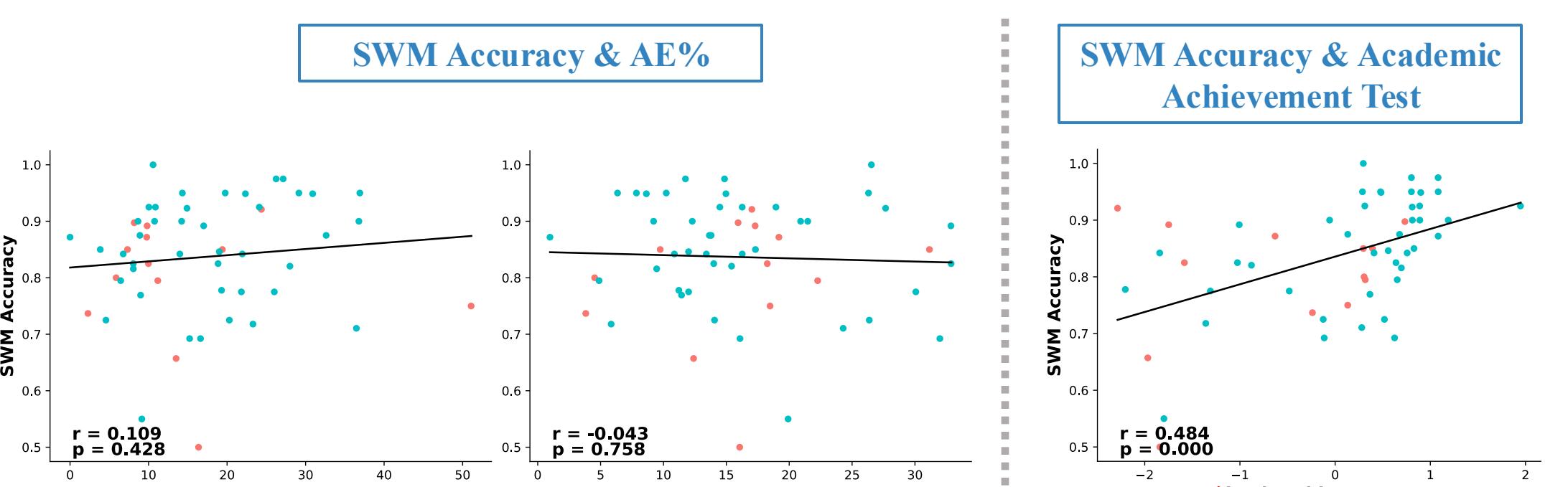
2. Lab: Alpha ERD during SWM



3. Correlations of Activity – SWM EEG



4. Correlations of the Behavioral Data



Conclusion

- Instructional context has a significant effect on attention and behavioral engagement during learning activities, regardless of ADHD diagnosis.
- Whereas SWM encoding alpha ERD is uncorrelated with these effects and instead predicts task performance and academic test performance.
- Laboratory measure may be narrowly capturing visual encoding during SWM, but this is not related to the behavior we associated with attention in natural activities, whereas the continuous alpha power capture background processes that are related to natural behavior.